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Project Summary

Offshore Platform Hazardous Waste Incineration Facility: Feasibility Study Summary

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This report summarizes the results of a feasibility study of using an existing offshore oil platform as a site for incineration of hazardous wastes and related research. Chevron U.S.A., Inc., has offered to transfer this platform, Main Pass Block 254 "A" Structure, to the Federal Government. The platform, located in the Gulf of Mexico approximately 100 km south of Mobile, Alabama, has potential as an environmentally safe site for operational and research oriented incineration activities. Results of the study indicate that a rotary kiln incinerator with a high temperature afterburner, capable of destroying a wide range of waste types at up to 3 metric tons/hour, can be installed on the platform along with the necessary support facilities. An environmental assessment of worst case air and water quality impacts from waste incineration revealed insignificant air quality effects at the nearest land point and on the platform. Water quality effects will not be significant for most wastes. For highly toxic and persistent substances, an activated carbon scrubber water treatment system will be provided. Estimated capital costs were $6.6 million for offshore and shore base facilities, and waste transportation containers. Labor, offshore personnel subsistence, fuel, transportation, maintenance, depreciation, and land lease costs were estimated at $3.9 million/year, or approximately $298/metric ton of waste incinerated for 12 hour/day, 7 day/week operation. Continuous and intermittent operation of the incinerator were also considered.

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This Project Summary was developed by EPA's Industrial Environmental Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Chevron U.S.A., Inc., has offered to transfer an offshore oil platform, Main Pass Block 254 "A" Structure, to the Federal Government. This platform, constructed in 1975 at a cost of $11,587,000, is located in the Gulf of Mexico approximately 100 kilometers (60 miles) south of Mobile Point, Alabama, and 120 kilometers (75 miles) east of North Pass, Louisiana. The U.S. Environmental Protection Agency (EPA) and the U.S. Coast Guard (USCG) have made a preliminary determination that the platform has potential for use in the disposal of hazardous material, including wastes resulting from

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cleanup operations. The evaluation took into account the necessity of destroying highly toxic waste at a location with minimum risk to public health and the environment, the need for further research on thermal destruction of hazardous waste, and the cost advantages of at-sea incineration.

This report summarizes the results of an evaluation of the technical and environmental feasibility of using the proposed offshore platform as an incineration facility for destruction of hazardous wastes and for incineration research.

Findings and Conclusions

Results of this study have demonstrated the basic technical and environmental feasibility of the proposed offshore platform for use as a hazardous waste incineration site. In addition, investigations undertaken as part of this study indicated the critical national need for an environmentally safe location for operational destruction of highly toxic substances and incineration research. Bases for these conclusions are as follows:

- Information obtained from EPA, USCG, and the literature revealed requirements for incineration of hazardous materials and waste combustion research that are more environmentally acceptable at an offshore site than at land-based facilities.
- Evaluation of both commercially and EPA-developed incineration systems indicates that a rotary kiln coupled to a high-temperature liquid-injection afterburner is the most versatile system for thermal destruction of a wide variety of waste types.
- A conceptually designed rotary kiln/afterburner incineration system, based upon commercially available, performance-proven components, can be installed and operated on the proposed ocean platform. Maximum design feed rates are 3.0 metric tons/hour of liquids and pumpable slurries, or 1.5 metric tons/hour of solid material.
- Although the platform deck area is limited, conceptual design of the offshore support facility has shown that all required subsystems including life-supprt systems and container handling, can be accommodated.
- A preliminary evaluation of the platform by the USCG in 1978 found the structure to be probably structurally adequate and in good condition. Structural analysis and testing were recommended before assumption of ownership by the Federal Government.
- A shore base facility was conceptually designed to meet all requirements for waste handling and storage, and standard commercially available containers were identified for transporting liquid and solid waste materials.

Need for Offshore Incineration Platform

During the past several years, disposal of oil and hazardous substances, resulting from cleanup of accidental or intentional spills and abandoned waste sites, has become increasingly difficult. Greater public awareness of hazardous substance disposal dangers has led to actions by many state and local governments to more closely control or eliminate existing landfill disposal areas and incineration facilities. Incineration of wastes on an offshore platform would provide an alternative to land disposal. Because even remote land sites are viewed as a long-term danger, construction of new facilities on land creates serious public opposition.

Although many other methods of waste disposal may be employed, high-temperature incineration is recognized as an effective means of total destruction of many highly toxic wastes. Incineration of wastes eliminates long-term risk to public health and/or the environment. It also eliminates costs associated with future monitoring and, thus, the risks incurred with liability. About half of the annual output of hazardous waste is organic and amenable to incineration. Incineration of hazardous wastes can be conducted at a land-based site, at sea on a specially constructed or modified vessel, or on an offshore structure.

Since 1969, at-sea incineration aboard ships has been employed by German and Dutch firms. Three specially equipped German tankers, the MATTHIAS I, II, and III, have been used for high-temperature incineration in the North Sea; only the MATTHIAS II is still in service. A Dutch vessel, the M/T VULCANUS, has been incinerating European wastes since 1972, and has also been successfully used, under permit from EPA, to incinerate organochlorine wastes in the Gulf of Mexico and Herbicide Orange in a remote area of the Pacific Ocean. The VULCANUS and MATTHIAS II can handle only pumpable liquid wastes of sufficient caloric value to ensure complete thermal destruction.

Because scrubbers are not required to control emissions, at-sea incineration is less costly on a per-unit basis than land-based incineration. However, the limited availability of such vessels and their restricted burn capabilities are disadvantageous.

Serious consideration should be given to locating incineration facilities on an offshore platform. Remote from populated areas, the facility's environmental controls could be based on proximity to land and meteorological and oceanographic conditions. The offshore siting has the further advantage of a broadened burn capability to include solids and slurries as well as liquids.

An offshore incineration platform could be used for the thermal destruction of industrial hazardous wastes, pesticides, toxic material and oil spills, as well as drums of contaminated soil and debris. Nearly all pesticides are decomposed by high temperature incineration including the persistent or multi-chlorinated hydrocarbons such as DDT and 2,4,5,-T. Incineration could dispose of the 1.2 million gallons of the now-banned silvex-containing herbicides. Other incinerable candidates for disposal at the offshore platform are organic solvents and monomers such as acetone, benzene, toluene, formaldehyde, acrylonitrile, phenol, styrene monomer, xylene, ethylene dichloride, and methyl alcohol, all of which have been involved in spills in recent years. The platform could be utilized for incineration of large quantities of waste or small batches to suit EPA and USCG needs.

Data gathered by the USCG Pollution Incident Reporting System (PIRS) indicate that only a small fraction of the substances spilled is recovered. Most of the spill becomes mixed with soil or water, increasing the volume to be

disposed of. Contaminated soil, wood, and debris would be candidates for offshore incineratoin along with the spilled material. No trends are evident in the amount or type of material spilled each year from the PIRS data. However, the data indicate that 5.3 million gallons or 69% of the 7.7 million gallons of hazardous material spilled during 1975-1978, were located in the Gulf of Mexico and neighboring states. An increasing portion of the total volume of material spilled occurred in this area each year: 18% in 1975, 27% in 1976, 67% in 1977, and 94% in 1978. A gulf site would therefore be advantageous for an operational incinerator facility to minimize the transportation of the hazardous wastes.

In addition to providing a facility for operational destruction of hazardous wastes in a location which minimizes the risk to public health, the offshore platform would also be a safe site to continue EPA's research into hazardous waste incineration. Trial burns of hazardous materials not previously incinerated could be conducted to establish optimum incineration parameters, determine destruction efficiency, identify combustinn products, and monitor emissions. Based upon these test results, suitability for incineration on land or at sea could be determined.

Offshore Incineration System

In order to select an incinerator design for the offshore platform, an evaluation was made of existing systems capable of incinerating hazardous materials. Both commercial and EPA developed systems were investigated during this study. It was concluded that a rotary kiln in conjunction with a liquid injection incinerator (used as an afterburner) represents the most versatile combination for thermal destruction of a wide variety of waste types. The rotary kiln utilizes mechanical mixing which permits the solid or liquid wastes to be exposed to hot oxidizing gas for as long as needed for their destruction. This incinerator is particularly well-suited for the destruction of solids and highly viscous sludges, including wastes resulting from cleanup of spills. The liquid injection incinerator also offers excellent mixing so that vaporized waste can be effectively destroyed. Consequently, a rotary kiln with a liquid injection afterburner was selected as the offshore incinerator for this feasibility study.

Conceptual Design

Design criteria for the conceptual incineration system were:

Feed rates–0.5 to 1.5 metric tons/hr of solid material or 1.5 to 3.0 metric tons/hr of liquids and pumpable slurries.

Shredder–capable of processing solid wastes, 55 gallon drums, soft metals, fence posts, etc.; enclosed to control fumes.

Rotary Kiln–operating temperature of 1000 to 1300°C, up to 1 hour solid residence time, negative pressure to minimize fugitive emissions.

Afterburner–operating temperature of 1300 to 1500°C, above 2 seconds gas residence time, 3% O_2 or greater (exceeds Federal Regulation requirements for incineration of PCB's), negative pressure.

Quench section–seawater injected to cool combustion gases to 300°C, allowing use of standard materials and bearings for induced draft fan.

Scrubber section–single pass seawater scrubber used only when adverse meteorological conditions occur during incineration of highly toxic wastes, or for selected research burns.

Effluent water treatment system–activated granular carbon is used to treat quench/scrubber effluents when required. The spent carbon is regenerated in the rotary kiln between incinerator operations.

Induced draft fans–used to provide combustion gas flow through the incineration system and maintain negative pressure to minimize fugitive emissions

Exhaust stack–combustion gases from the incinerator will be exhausted through a 15 meter (50 ft) high stack to preclude "downwash" of the plume.

Control/data acquisition system–both incinerator process control functions and data acquisition will be performed by a single digital computer system. Process controls will incorporate safety interlocks, programmed start-up and shutdown cycles, and warning alarms. Combustion efficiency will be continuously calculated and displayed along with all process parameters and air pollutant monitoring data. Data can be transmitted directly to shore based facilities.

Monitoring Plan

Monitoring offshore incineration activities will provide information needed for predicting, maintaining and documenting conditions for the safe disposal of waste materials and for protection of personnel and environment.

Monitoring will begin with the acquisition of a representative sample of the waste material at the waste generation or spill site. Analysis of this sample of the shore based support facility will determine handling and combustion requirements. During incineration, various indicators of combustion efficiency will be monitored by on-line gas analyzers, and samples will be collected for laboratory analyses to determine waste destruction efficiency.

On-line gas analyzers and collected samples will also be used to monitor pollutants in the final air emissions, liquid effluents, and solid residue from the incineration system. The potential introduction of contaminants into the storage and work areas from fugitive and other inadvertent sources will be monitored. Because of the close proximity of the crew's living quarters to the waste storage and incineration areas, monitoring for the introduction of contaminants into the quarters will also be needed. For personnel safety, as well as for the the protection of the platform structure itself, meteorological and oceanographic conditions (such as wind speed and direction) will be monitored to prevent undesirable exposure to toxic or corrosive emissions.

The foregoing monitoring activities require specialized equipment and facilities which will involve both the shore based support facility and the offshore platform In general, the shore based facility will be equipped to perform the more sophisticated, detailed analyses on collected samples, while the offshore facility will perform

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on-line measurements and quick-response analyses.

Most of the data resulting from the monitoring activities will be handled by the platform facility's computer. Direct measurements by monitoring instruments will be digitized for interfacing directly with the computer. Visual observations and data resulting from laboratory analyses will be entered manually. The computer will then store, reduce, and analyze the raw data. Outputs will include information needed by the platform facility operators, complete reports of raw or reduced data, and transmissions to the shore based support facility.

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The complete report, entitled "Offshore Platform Hazardous Waste Incineration Facility," is in two parts:

Feasibility Study Summary (Order No. PB 81-178 303; Cost: $6.50)

Feasibility Study (Order No. PB 81-190 951; Cost: $20.00)

These reports will be available only from: (prices subject to change)

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